Iron and Steel Welding

THE enormous change in the general outlook on welding which has taken place during the last twelve or fifteen years was never so well exemplified as by the attendance of some nine hundred persons at the first meeting of the symposium on the welding of iron and steel organised by the Iron and Steel Institute with the co-operation of fifteen other scientific and technical societies, and held at the Institution of Civil Engineers on May 2–3. Sir Harold Carpenter presided, and pointed out that the whole question of welding had been raised by Dr. H. J. Gough for the consideration of the Department of Scientific and Industrial Research.

The object of the symposium was of a two-fold character. It was designed in the first place, and mainly, to discover what is now known, and in the second place to map out fields of work for future development. Although welding is still in large measure an empirical art, a considerable amount of fundamental scientific work is now being done, and the results of this have been brought together in a collection of papers which represents by far the most important and comprehensive collection of information on the welding of the ferrous metals which has ever been made. The papers were divided into a series of groups, of which the first dealt with present-day practice and problems connected with welding in the engineering industries. Shipbuilding, bridge and structural engineering, railway material and pressure vessels, formed one sub-section of this group, the other dealing with the aeronautical and automobile industries, the production of chain, the electrical, heavy engineering and machinery industries and the welding of iron and steel castings and of wrought iron.

Group 2 was concerned with the practice and technique of welding, including the apparatus and plant required. The metallurgy of welding, and the questions of specifications, inspection and testing formed Groups 3 and 4. It will come as a surprise to many to discover how much real research is being done, and how fundamental are the advances which are being made, at any rate in certain directions.

From the various papers and discussions certain suggestions emerge regarding the lines on which future development and research might usefully proceed. These include:

(1) The development of plant for electric welding in which the current is automatically adjustable to suit the rate of deposit, together with the necessary control of the arc.

(2) Despite the work which has already been done, there are still very considerable gaps and discrepancies in our information regarding the factors which affect the fatigue resistance of all types of welded joints, particularly in comparison with similar solid, bolted or riveted constructions, and extensive research work on this point is most essential.

(3) The investigation of the effect on the fatigue strength of various types of treatment and electrodes and the comparative influence of alternating and direct current.

(4) The development of forms of welded construction which are based on a real knowledge of the fatigue properties of the welds for dynamically loaded structures (such as bridges).

(5) Work on the welding of the high carbon and alloy steels.

(6) Work on non-destructive methods of testing welded joints.

No aspect of welding, so far as it is applied to iron and steel, was omitted from this highly successful symposium. The most grateful thanks of producers and users of welded structures are due to those responsible for the meeting on one hand, and the authors of the papers on the other. The only note of a critical nature which can possibly be struck is the fact that the material presented was of such enormous dimensions that the time available for its discussion was inevitably greatly restricted. A further discussion of this material at some future date would form a fitting corollary to the meeting already held.

F. C. T.

Royal Observatory, Greenwich

ANNUAL VISITATION

THE Astronomer Royal read his report to the Board of Visitors of the Royal Observatory, Greenwich, on the occasion of the annual visitation of the Observatory on June 1.

The construction of the new reversible transit circle has been completed by Messrs. Cooke, Troughton and Simms, Ltd., and the instrument is undergoing final tests. The construction of the two glass circles of 28 inches diameter, and the etching of divisions spaced at intervals of 5 minutes of arc have been carried out successfully. When completed, the new transit circle will be housed in the Christie enclosure next the Yapp 36-inch reflector. A contract for a slit spectrograph for use with the latter telescope has been placed with Messrs. Adam Hilger, Ltd. This spectrograph is designed for use with one or three prisms at will, the optical parts being made from ultra-violet glass giving good transmission down to 3500 A.

During the year, 9,576 transit observations were made, including 130 observations of the sun and 94 of the moon. The observations of the moon continue to show a decrease in the correction to the longitude given by Brown's Tables, which were introduced into the *Nautical Almanac* in 1923. Nova Herculis was observed on the meridian six times above pole and twice below pole. The position for 1935·0 is α 18^h 5^m $39{\cdot}85^s$, δ $+45°$ $50'$ $54{\cdot}2''$ (Epoch 1934·99). 42 plates were exposed on Nova Herculis in the slitless spectrograph attached to the Yapp 36-inch equatorial reflector. All these have been calibrated for photometry, and where possible a comparison star has been included. These plates will provide material for the study of the distribution of energy throughout

the spectrum. In addition, work has been carried out with the new telescope on the programme of colour temperature work.

The spectrohelioscope at Greenwich was used on 179 days. A photometer has been added to the instrument in such a way that the intensities of prominences and bright patches on the solar disc can be measured in terms of the brightness of the undisturbed disc in wave-lengths outside the absorption line concerned. Measures of prominences have been made both in Hα and Hβ. Work on the intensities of the Fraunhofer lines has been commenced. A hut has been built in the Christie enclosure, in which a 16-inch cœlostat has been mounted. Sunlight is fed into the basement below the 36-inch equatorial, where it is analysed by a 4-inch concave grating.

Magnetic observations have been carried out at Abinger throughout the year. The mean values of the magnetic elements for the year 1934 are as follows:

Declination,	W. 11° 41·1′
Inclination,	66° 39·7′
Horizontal Intensity,	0·18533
Vertical Intensity,	0·42955

Some innovations have been introduced with the meteorological observations. Regular observations of the amount of solid matter suspended in the air were commenced on July 1, 1934. In November last, the worst month, a mean weight of 178 mgm. of solid impurity was found in each 100 cubic metres of air. Compared with the figures recently published for the previous year at other stations, it would appear that the pollution at Greenwich is fully as great as that at any London station, and is not on the average surpassed by any reporting station in Britain, although in Central Glasgow the pollution is worse at the worst times of the day. The gaseous pollution of the atmosphere by sulphur dioxide has also been measured daily from January 1, 1935.

The mean temperature for the year was 51·9°, which is 2·4° higher than the average for 1841–1915. There were 79 entirely sunless days, and only 39 entirely cloudless nights, that is, nights on which Polaris left an unbroken trace on the night sky camera.

A number of improvements have been introduced in the detailed working of the observations for time with the small reversible transit circle. Three observers are employed, instead of one, and the observations are corrected for personal equation to the mean of three observers. (It is hoped shortly to construct a personal equation machine and obtain absolute personalities.) Again, the chronograph and relay system has been brought up to date, and an oscillograph is now used to determine lags in the reception of wireless signals. The accordance between Greenwich time and that sent out by foreign observatories is now much closer than was the case a few years ago. The mean difference for 1934 between Greenwich and Paris is $-0{\cdot}018^s$, and that between Greenwich and Nauen is $+0{\cdot}013^s$, the sign + meaning late on Greenwich.

During the past year, Mr. Furner, assistant, retired after forty-six years' service, and Mr. Blackwell was appointed junior assistant.

Concluding his report, the Astronomer Royal referred to the atmospheric pollution, which hampers astronomical work. Silvered mirrors and circles tarnish rapidly, and soot and grit are deposited. A further difficulty is due to the increasing brightness of the sky at night, which results from the use of mercury lamps for street lighting. Photographic work with rapid plates at low altitudes in the sky is impossible in certain directions in which the new lighting is extensively used, and representations have been made to the Greenwich Borough Council on the subject of street lighting.

R. v. d. R. W.

Alchemy and Music

THE first combined meeting of the Chemical and Musical Societies in the history of the ancient University of St. Andrews was held in the Chemistry Lecture Theatre of the United College, St. Andrews, on April 24, when Prof. John Read, professor of chemistry, delivered an illustrated lecture under the title: "The Frankfurt Emblems: a Research in 17th Century Alchemy". The culminating event of the evening was the singing, possibly for the first time in three hundred years, of some unique alchemical music which Prof. Read encountered some time ago in his alchemical studies, and which has formed the subject of a recent research by Mr. F. H. Sawyer, lecturer in music in the University of St. Andrews.

Alchemy, said Prof. Read, has been variously defined as the pretended art of transmuting base metals into gold, as the chemistry of the Middle Ages, and so forth; but in its broadest aspect it was a system of philosophy which claimed to penetrate the mystery of life as well as the formation of inanimate substances. Like modern science, alchemy had its theories, notably the theory of the four elements, with the allied conception of the Philosopher's Stone, and the sulphur-mercury theory of the constitution of metals. Alchemical theory, however, like alchemical symbolism, is a complex and intricate subject, rendered even more difficult by its protean character of change. The age of alchemy extended approximately from the early years of the Christian era until the end of the seventeenth century.

Among many features of interest in the declining years of alchemy are the piquant illustrations, so racy of the alchemical soil of the seventeenth century. The Twelve Keys of the mysterious Basil Valentine, in particular, were handled repeatedly by new artists, who provided them with an honoured place in alchemical publications of this time. Each of the Keys consists of an emblem with an allegorical description.

Judging from the age-long popularity of Ben Jonson's play, "The Alchemist", which was first produced in 1610, there was a considerable public throughout the seventeenth century for attractive expositions of alchemy. Frequenters of the playhouses of those days were familiar with that technical language of contemporary alchemy and astrology which is so much 'heathen Greek' to the modern playgoer. Thus, the production of titillating alchemical works, abounding in pictorial illustrations, came probably as a response to a wide demand.

The first issue of the Basilian emblems appears to have been made from Frankfort; and other